



Microwave discharge produced plasma for EUV light source

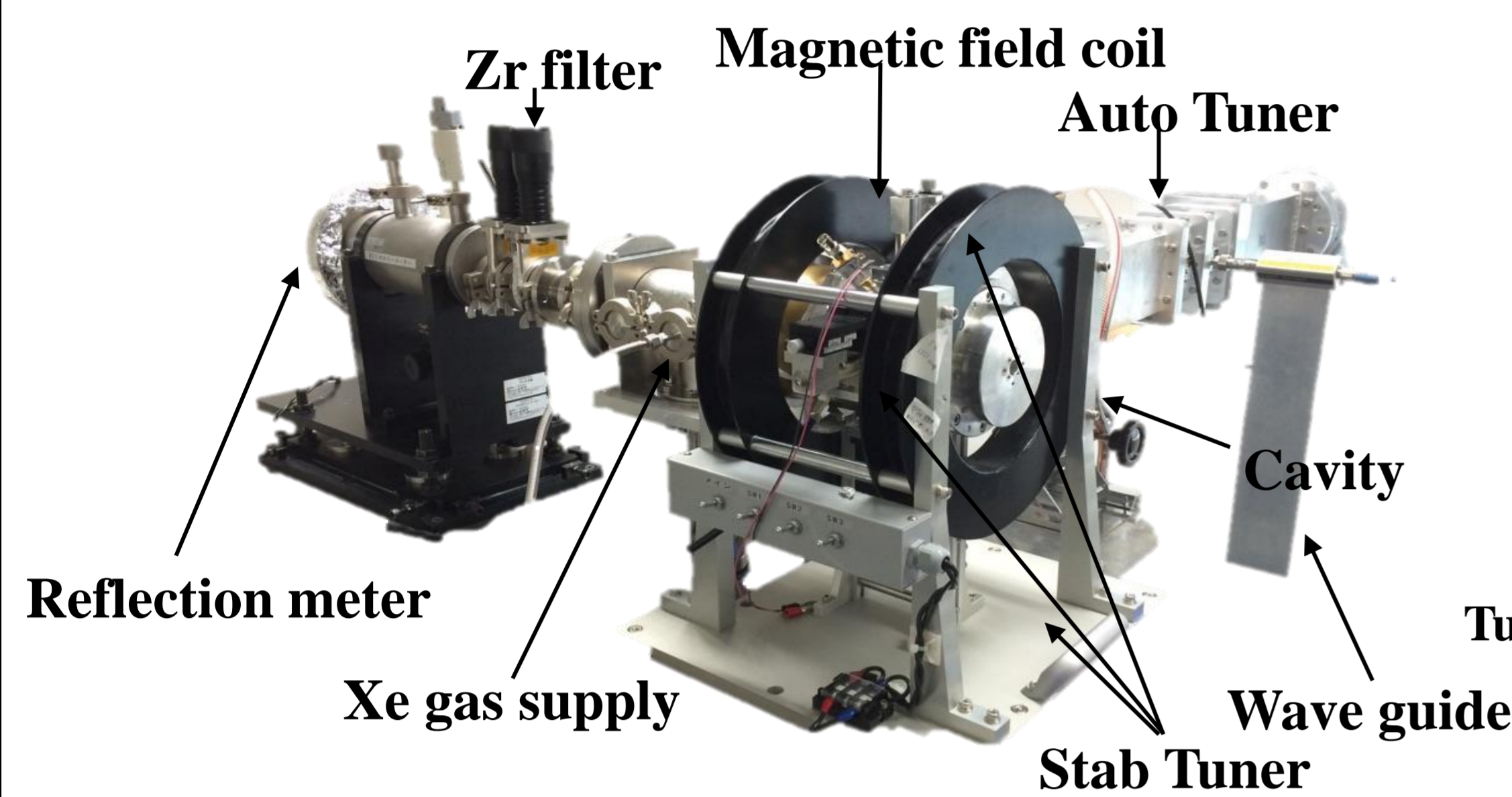
—Load to Commercial EUV Source—

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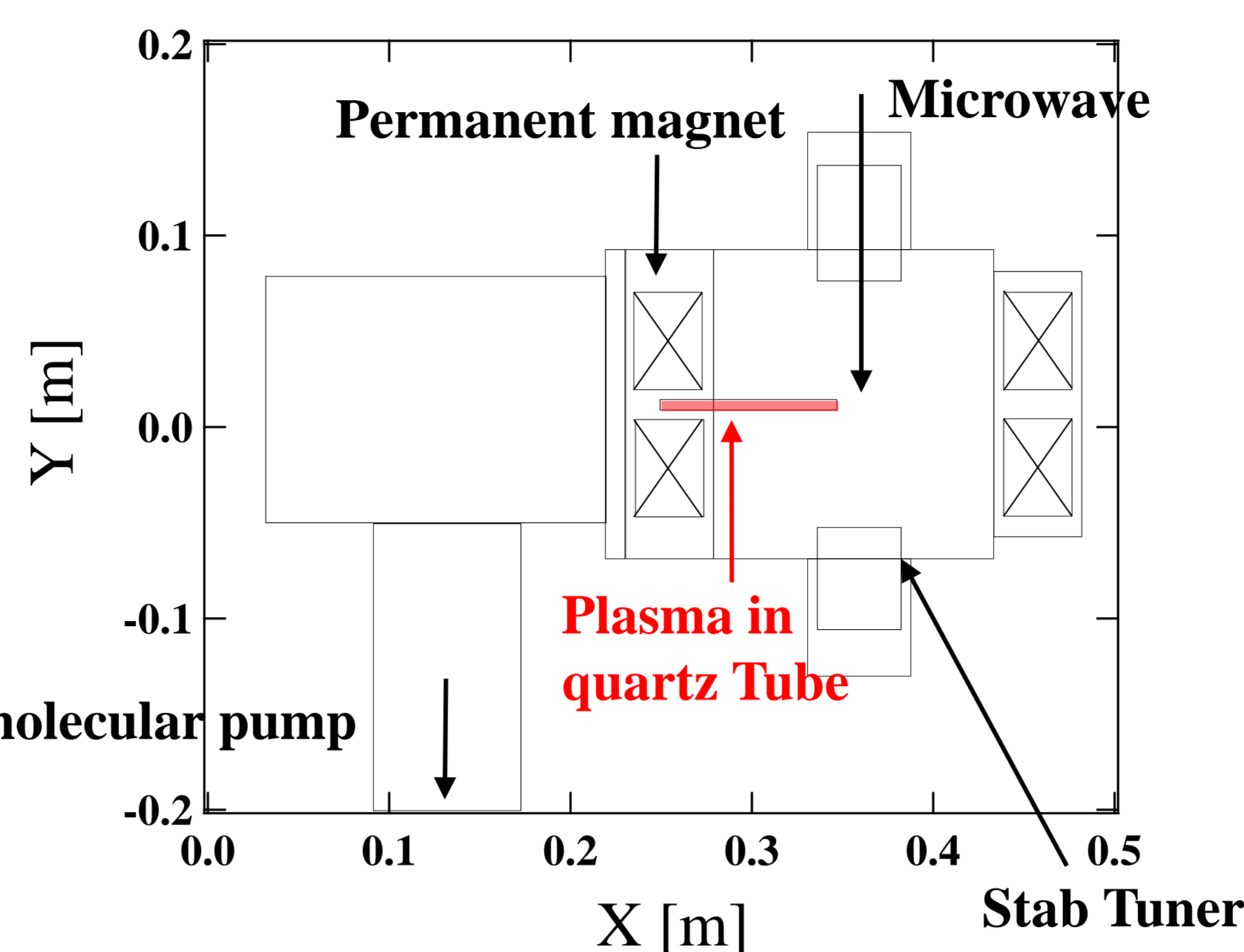
Abstract

A new EUV light source has been developed for the lithographic application. The source consists of the microwave oscillator, the wave guide, the tuner, the resonant cavity and the capillary tube. The compact size and the high efficiency realize the distinguished EUV source with a low cost. The EUV power of 250W or more, however, is required for the lithography. The high demand can be resolved by using the multi-sources, e.g. combining multiple sources. When one module emits 25W EUV power, the integrated source of ten modules produces 250W EUV power, keeping the etendue less than the restricted values.

Experimental facility



MDPP facility

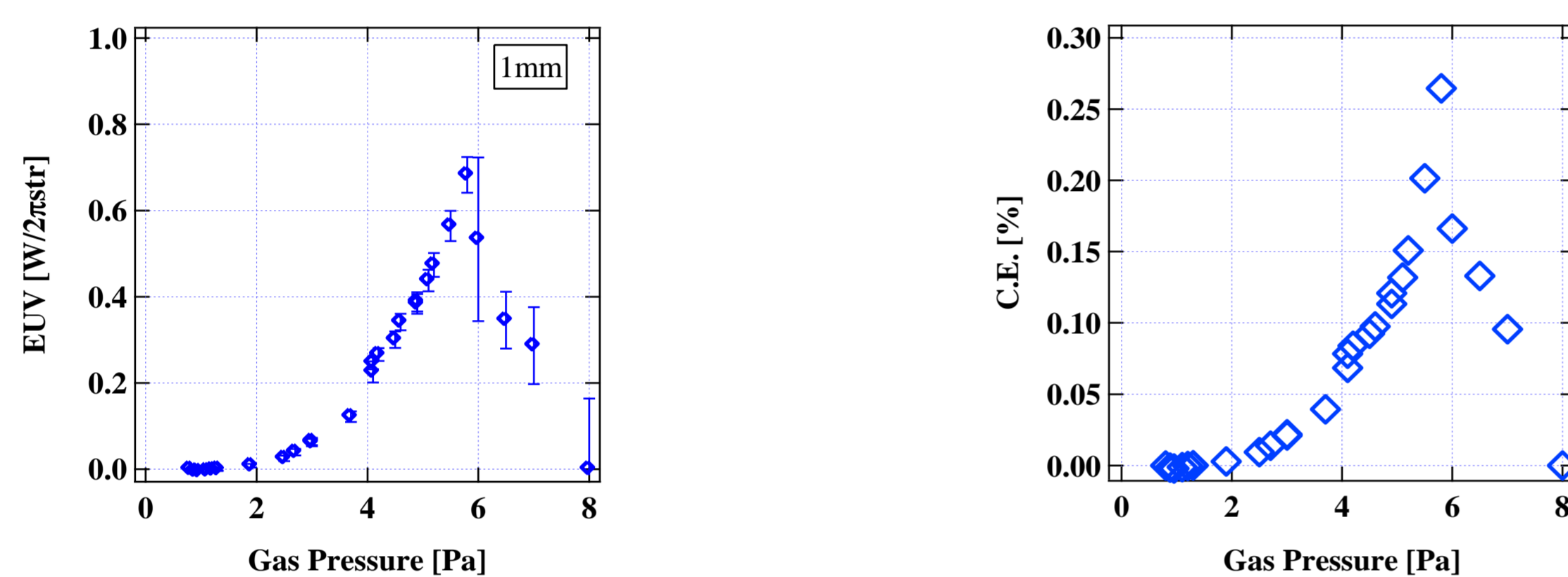


The cylindrical cavity mode is TM010 and TE111.

Advantages of MDPP

- CW/pulse operation giving a high duty.
- High overall efficiency.
EUV power / Electric power >0.1%
- Compact size affordable for multi-source structure.
- Cheaper cost because of simple composition.
(Oscillator + resonance cavity)

Present Experimental Result

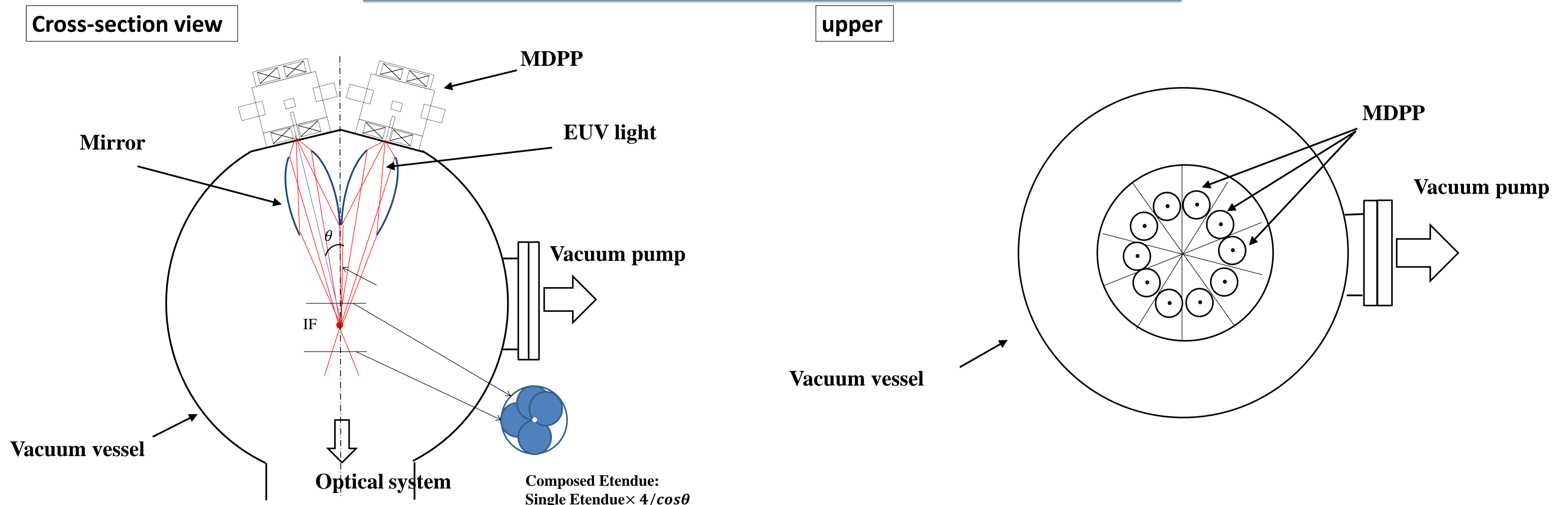


The EUV output is 0.7W@2πsr for 250W input power.
The CE achieved 0.3%.

Estimated EUV power

- The increase of the microwave power affords to operate at the higher gas pressure.
- The CE may be improved over 0.5% at IF.
- The 5kW microwave produces 25W EUV.
- Ten multiple sources achieves 250W EUV power.

Conceptual drawing of multi-EUV sources



Time schedule for development



Conclusions

- Microwave Discharge Plasma Production has the features of no debris production, high efficiency operation(CW), and cheaper construction cost.
- Multiple source structure will 250W EUV light source in 2016.

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